

A HYDROSTRATIGRAPHICALLY-BASED
HYDROGEOLOGIC FRAMEWORK FOR SEDIMENTARY BEDROCK: PROVIDING IMPROVED
CONTEXT FOR SITE-SPECIFIC INVESTIGATIONS

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Regional-scale sedimentary aquifer characterizations used by environmental managers as a starting point for investigations of local groundwater contamination are commonly substantial simplifications of much more complex hydrogeologic systems. We have constructed a regional-scale characterization of hydrostratigraphic attributes, *sensu stricto*, for the relatively undeformed Lower Paleozoic sedimentary bedrock in southeastern Minnesota that shows the spatial distribution of both matrix and secondary porosity. Thousands of borehole geophysical logs and hundreds of laboratory analyses of matrix porosity and permeability were tied to detailed (largely 1:100,000 or greater), conventional, lithostratigraphic maps. We compiled and conducted a large number of hydraulic tests of discrete hydrostratigraphic components (packer tests and borehole flowmeter and video logging) and analyzed thousands of specific capacity tests to produce the hydrogeologic framework. Nearly the entire Paleozoic aquifer system has representative outcrops and we incorporated field observations of the distribution of secondary pores and their hydraulic significance. Borehole investigations demonstrated that many of these field observations can be extrapolated into the deeper subsurface because the development of secondary porosity is commonly controlled by stratigraphy. Dye trace and water chemistry investigations were also important tools that provided particularly important information that allows our regional framework to provide context for site-specific characterization.

Our new hydrogeologic framework more accurately depicts this aquifer system's heterogeneities. It improves prediction of well yields, flow paths and speeds over the regional framework in use for the past few decades. The markedly higher definition of individual aquifers and confining units and quantification of their hydraulic properties greatly facilitates site specific characterization. Of particular importance is the recognition that discrete intervals of exceptionally high conductivity, commonly bedding-plane fractures, dominate the hydraulics of aquifers *and* confining units in siliciclastic as well as carbonate-dominated strata. This has substantial implications for site-specific investigations, particularly for the determination of contaminant concentration, flow paths and travel times.

